PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Restore Upper Toppenish Creek Watershed

BPA project number: 9803300
Contract renewal date (mm/yyyy): 10/1999 ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Yakama Indian Nation

Business acronym (if appropriate) YIN

Proposal contact person or principal investigator:

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NPPC Program Measure Number(s) which this project addresses
7.6A-D, 7.8A, B, E

FWS/NMFS Biological Opinion Number(s) which this project addresses

Other planning document references
Wy-Kan-Ush-Me-Wa-Kish-Wit, Yakima River Subbasin Plan, basinwide recommendations 3-5, pp. 58-59

Short description
Moderate flow regime in Toppenish Creek by increasing the retentiveness of natural soil water storage areas, such as headwater meadows and floodplains, following prioritized plan generated by FY98-99 analysis.

Target species
Mid-Columbia summer steelhead

Section 2. Sorting and evaluation

Subbasin
Toppenish Creek watershed, Yakima River subbasin

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more	If your project fits either of these	Mark one or more categories

caucus	processes, mark one or both	
☒ Anadromous fish ☐ Resident fish ☐ Wildlife	☐ Multi-year (milestone-based evaluation) ☒ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☐ Operation & maintenance ☐ New construction ☐ Research & monitoring ☒ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description
20547	Yakima Subbasin Habitat/Watershed Project Umbrella
9603501	Satus WAtershed Restoration
9803300	Restore Upper Toppenish Creek Watershed
9705300	Toppenish-Simcoe Instream Flow Restoration and Assessment
9206200	Yakama Nation Riparian/Wetlands Restoration
9705100	Yakima Basin Side Channels
9705000	Little Naches Riparian and In-Channel Restoration
9803400	Reestablish Safe access Into Tributaries of the Yakima Subbasin
9901300	Ahtanum Creek Watershed Assessment
20117	Yakima Subbasin Assessment

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
	Yakima/Klickitat Fisheries Project Umbrella	Dependence of supplementation on habitat carrying capacity

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Stabilize headcuts	a	Using machinery and hand labor, lay headcuts back to a stable slope and armor with rock or geotextile.
2	Retain sediment in degrading channels	a	Using machinery and hand labor, install low, permeable rock structures in incised, widened ephemeral and intermittent channels.

3	Stabilize sediment deposits	a	Build exclosures in incised, widened ephemeral/intermittent channels.
		b	Vegetate with appropriate plant species.
4	Enhance channel/floodplain interactions	a	Remove or set back streamside dikes.
		b	Use large dike material to increase overbank flow or to increase roughness in degraded alluvial stream reaches.
5	Stabilize eroding uplands	a	Revegetate sensitive upland areas, i.e., those transitional between sheet flow and channelized flow zones.
	Note: tasks b and c will also support objectives 1, 2, 3, and 4.	b	Repair, replace, and relocate fences.
		c	Install new water lines and troughs.

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	5/1999	9/2000	Stabilization of 100% of treated headcuts, 3 years after treatment.		10.00%
2	5/1999	9/2000	Retention of >3 inches of sediment behind >75% of the structures within 3 years, assuming sediment-moving events occur at least annually.		25.00%
3	5/1999	7/2000	75% ground cover of desirable native plant species in exclosures within 2 years of revegetation activities.		10.00%
4	5/1999	9/2000	Magnitude of flow required to over-top banks is measurably reduced		30.00%
5	5/1999	9/2000	Headward rill development is arrested in 3 years		25.00%
				Total	100.00%

Schedule constraints
Weather is the major constraint on operations. Winter conditions can inhibit access over primitive roads or in stream channels. The length of the season for propagating vegetation is limited by duration of soil moisture

Completion date
FY 2001

Section 5. Budget

FY99 project budget (BPA obligated): $100,000

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel	See budget narrative for details.	%38	79,289
Fringe benefits	at 25.3%	%10	20,060
Supplies, materials, non-expendable property	Office, seed, erosion control, revegetation, fencing, water development, miscellaneous.	%10	20,450
Operations & maintenance	Office rental, utilities, vehicles, fuel, repairs, equipment rental, insurance	%23	47,215
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		%0	
NEPA costs		%0	
Construction-related support		%0	
PIT tags	# of tags:	%0	
Travel		%0	600
Indirect costs	@ 23.5%	%19	39,389
Subcontractor		%0	
Other		%0	
TOTAL BPA FY2000 BUDGET REQUEST			$207,003

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
		%0	
		%0	
		%0	
		%0	
Total project cost (including BPA portion)			$207,003

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$350,000	$375,000	$75,000	$80,000

Section 6. References

Watershed?	Reference
☐	Anonymous. 1975. Water resources of the Toppenish Creek basin, Yakima Indian Reservation, Washington: U.S Geol. Surv. Water Resources Investigations 42-74.
☐	Hendry, J., S. Armstrong and T. Ring. 1992. Application of environmental isotopes to the study of groundwaters in the Toppenish Creek Basin, Washington. In: Jones, M.E. and A. Laenen, eds. Interdisciplinary approaches in hydrology and hydrogeology.
☐	Maidment, D.R., ed. 1993. Handbook of hydrology. McGraw-Hill. P. 8.22
☐	Mundorff, M.J., R. D. MacNish and D. R. Cline. 1977. Water Resources of the Satus Creek Basin, Yakima Indian Reservation, Washington. U.S. Geol. Surv. Open-File Report 76-685. 102 pp
☐	Reichmuth, D.A. 1996. Living with fluvial and lacustrine systems: an introduction to river

	and lake mechanics. Geomax Professional Engineers, Spokane WA. Pp. 53-85.
☐	Stanford, J. A. and others. 1995. A general protocol for the restoration of regulated rivers. Regulated Rivers: Research and Management (in press).
☐	Stanford, J.A., and J. V. Ward. 1988. The hyporheic habitat of river ecosystems. Nature 335: 6185. Pp. 64-66.

PART II - NARRATIVE

Section 7. Abstract

Restoration of the Toppenish watershed (comprising more than 10% of the Yakima sub-basin) is critical to restoring healthy runs of steelhead to the Yakima River. This proposal addresses degradation in the upper watershed, complementing three major restoration efforts underway in the lower, agricultural area. Proposed activities, following a FY98-99 analysis, are based on the assumption that aquatic/riparian habitat is an expression of watershed functioning. Our goal is to improve steelhead habitat by moderating flows from the upper watershed. The most efficient means is to restore the retentiveness of those areas, such as headwater meadows and floodplains, which formerly provided soil water storage. The objectives are to reduce erosion, aggrade downcut channels, and restore channel/floodplain interactions. The methods for achieving these goals include: 1) improved grazing management, 2) stabilization of headcuts and construction of sediment traps in headwater areas using native materials and geotextiles, 3) revegetation of sediment deposits and eroding uplands, and 4) removal of dikes. Monitoring of headcut stability, channel aggradation, and percent native vegetative cover in treated areas will allow us to evaluate the effectiveness of these treatments in meeting our objectives 3 years after application. We assume that meeting these objectives will gradually increase the hydrologic retentiveness of the upper watershed, thereby moderating flow regimes.

This proposal is consistent with the 1994 Columbia Basin Fish and Wildlife Program, Measures 7.6A-D, 7.8A, B, E and with *Wy-Kan-Ush-Me-Wa-Kish-Wit*, Yakima River Subbasin Plan, basinwide recommendations 3-5, pp. 58-5,9 which emphasize the importance of healthy watershed functioning to aquatic habitat.

Section 8. Project description

a. Technical and/or scientific background

Physical Setting

Toppenish Creek is approximately 75 miles long, discharging into the lower Yakima River near Granger at river-mile 80.4. Its 625-square-mile watershed comprises more than ten percent of the Yakima Basin and lies wholly within the Yakama Indian Reservation. Simcoe Creek, which drains an area of 141 square miles, discharges into Toppenish Creek near its midpoint. Both Toppenish and Simcoe Creek flow through the Wapato Irrigation Project (WIP). Upon reaching the agricultural lands of the Toppenish Valley, both creeks are heavily diverted by private irrigators and by WIP. Farther downstream, both creeks receive heavy flows of warm and turbid Project tailwater.

The Toppenish Creek watershed can be broadly subdivided into an upland region and a lowland region (Anonymous 1975). The lowland region consists of a broad valley floor made up of gravels and other sediments delivered to the valley by Toppenish Creek, its tributaries, and by the Yakima River. The lower 40 miles of Toppenish Creek flow across this alluvial valley. Through this valley reach, the creek is subjected to a host of alterations by agricultural activities, flood control, and road building.

In the Toppenish Creek watershed uplands, the most important natural mechanisms for moderating runoff occur in the meadow complexes high in the watershed, and in flood plain reaches in the complex of canyon streams draining the upland.

The drainage divide separating the Toppenish Creek drainage from the Klickitat River drainage to the west is not a sharp, well-defined divide, but rather a broad plateau underlain by nearly horizontal volcanic rocks. This plateau features several large meadow complexes. These meadows capture a portion of the snowmelt-generated seasonal runoff and return this water to the stream system along flow paths varying in length from a few feet to tens of miles. Much of the late summer flow in Toppenish Creek is sustained by rainfall and snowmelt which had earlier infiltrated into the soils on the plateau. Previous studies have indicated that recharge from this plateau area is also the source of water for groundwater flow in the deep aquifer system discharging to the Yakima River, tens of miles east of the source (Hendry et al. 1992).

Lower in the watershed, streamflow is largely in narrow canyons having little ability to store and release water. At places within the drainage, however, gravel flood plains act to retard runoff, diffuse stream energy and cool the streams by storing and releasing cold spring runoff. Such alluvial flood plain reaches serve as centers of productivity of the aquatic food web upon which steelhead rely.

Fisheries Resources

The long term goal of the Yakama Indian Nation is to restore summer steelhead to harvestable levels, while maintaining the genetic integrity and adaptability of the population. The Yakima Subbasin Plan outlined in Volume II, Wy-Kan-Ush-Mi-Wa-Kish-Wit, establishes a summer steelhead adult return goal of 29,700 for the entire sub-basin. This will involve restoring terrestrial and aquatic habitat to conditions capable of supporting all freshwater life history stages of summer steelhead.

The Toppenish Creek basin supports a small summer steelhead run which has significantly declined over the last decade. The population nevertheless appears to be genetically distinct from other populations in the Yakima Basin (C. Busack, WDFW, pers. comm.). Juvenile steelhead are spawned and reared primarily upstream from irrigation diversions in Toppenish Creek and its North Fork.

Using a combination of redd counts and radiotagging data, an adult steelhead run size of 50 to 100 fish seems to have been typical for the years 1989 through 1992. Since then, adult escapements to Toppenish Creek are likely to have followed the downward trends seen elsewhere in the Yakima River Subbasin.

As noted in the FWP, "improv[ed] habitat quality [is] needed to increase the productivity of many stocks. Reduced habitat quality results in lower survival during critical spawning, incubation , rearing and migration periods.... Improved habitat quality would allow greater juvenile and adult survival at each freshwater life stage and can result in more offspring surviving to begin migration to the ocean.".

This proposal extends the restoration activities undertaken by the Satus Watershed Project into the adjoining Toppenish watershed. Collectively, these two watershed account for 20% of the Yakima River Subbasin and have in recent years produced 40-50% of the steelhead in the Yakima Subbasin. This Yakima is thought to have been the 'fish factory' of the Columbia basin (Jack Stanford, University of Montana, pers. comm.).

b. Rationale and significance to Regional Programs

Rationale:

It is a first principle of watershed hydrology that runoff of snowmelt or rainfall is slowed by natural watershed processes, with the result of decreasing peak flows and increasing base flows (e.g., Dunne and Leopold 1978). This process occurs as water enters temporary storage within the watershed during times of high precipitation or runoff and is released from storage as streamflow during times of limited precipitation and runoff. Streamflow regime – a reflection of the climate and the storage and release mechanisms within the watershed – drives the evolution of the drainage system and associated aquatic/riparian ecosystems. Because of the climatic patterns and general aridity of the Toppenish Creek basin, these mechanisms are especially critical to sustaining aquatic life. Because these processes naturally moderate the magnitude of floods and increase the delivery of streamflow to lowland areas during summer, they are also of great importance to downstream human residents of the watershed.

The natural capacity of a watershed to store water is not evenly distributed across the landscape. Some areas have a high capacity to allow the infiltration of water from the surface and a disproportionately large volume in which to store precipitation and runoff, while other areas are relatively impervious to infiltration and have a relatively low volume of porous material in which to store water. Watersheds that have a high capacity to store water have relatively lower peak flows and higher base flows than watersheds with similar climate, but less natural storage. When the storage mechanisms in a watershed become degraded, peak flows increase and base flows decrease. Effects of these changes include destabilization of stream beds and banks, hotter summer stream temperatures, loss of native vegetation and animal life, and proliferation of non-native species. Restoring the hydrologic function of storage areas and removing the causes of degradation have been shown to drive rapid change back toward natural runoff patterns and native ecosystem function (Stanford et al 1995).

Typically, climatic conditions in east side watersheds cause the seasonal snowpack to melt off relatively early in the season (Anonymous 1975; Mundorff et al 1977). Melting of the snowpack is generally not sufficient to provide streamflow through the long, dry summer season. The fact that the streams flow at all in the late summer is a demonstration that the watersheds are releasing previously stored water.

Air temperatures east of the Cascades are high during the summer and cold during the winter. The same mechanisms which decrease peak flow and increase base flows act to moderate stream temperatures. Most water enters into storage in spring, when water temperatures are cold. Once in the ground, the water comes into thermal equilibrium with the surrounding soil or sediment. Release of this water during summer cools the streams and provides thermal refugia for fish. At the other extreme, during winter, discharging groundwater locally prevents freezing of streams, again providing thermal refugia.

Under natural conditions, the areas of natural storage in watersheds typically stayed relatively wet and maintained high water tables well into the summer. This pattern caused them to be populated by characteristic plant and animal life dependent on such conditions. These areas tend to be the focus of biological production and diversity in the watershed, giving them importance far out of proportion to their areal extent (Stanford and Ward 1988). In their degraded condition, many meadow and riparian complexes have become incised, limiting opportunities for water to enter storage and causing rapid draining and desiccation of the soil or alluvium. As a result, native wetland vegetation has been replaced by upland vegetation. Native animal species have suffered in kind, greatly reducing the ecological diversity of the entire watershed.

Channels downstream of areas of natural storage evolved configurations largely controlled by the patterns of inflow from above. Loss of natural storage upstream causes channel widening or incision, due to higher peak flows. The enlarged channels then receive less summer flow. The results are less usable habitat in the channel during the summer. Heightened water stress to riparian vegetation can further reduce bank strength, causing a cycle of increasing instability. Restoration of lost natural storage function upstream will drive passive restoration of such downstream reaches. This approach has been demonstrated to yield better results than active restoration attempts using instream structures in controlling channel changing processes that are being driven by upstream changes in runoff processes.

In summary, the rationale underlying this project is that the stream/riparian system is an expression (integration) of the functioning of the entire watershed, i.e., the landscape-scale interactions between water, soil, and vegetation. Furthermore, the long-term sustainability of aquatic and terrestrial ecosystems rely on developing land uses which allow the water-soil-vegetation interactions to remain within a natural range of variability. Vegetation is the key to stabilizing soils and moderating the routing of water and sediment through the watershed; active and passive management of the vegetation is our primary tool for restoring watershed functioning and normative channel conditions. This approach is consistent with both *Wy-Kan-Ush-Mi-Wa-Kish-Wit,* and the goals and objectives of the FWP, as illustrated by the sections quoted in Section 7a.

Relation to regional plans

This project is consistent *with Wy-Kan-Ush-Me-Wa-Kish-Wit*, Yakima River Subbasin recommendations, Yakima River Subbasin Salmon and Steelhead Production Plan, Steelhead Strategies 2-7, and dovetails with other projects in progress in Toppenish Creek Basin, including the Yakima River Basin Water Enhancement Project, (Title XII), a major effort to restore streamflow, habitat and fish runs in the Yakima River Basin. Restoration efforts are being planned for the extensive alluvial fan system in the Toppenish Creek lowlands, where summer flows are critically low; the proposed restoration in the upper watershed is needed to provide base flows throughout the canyon and alluvial fan systems of Toppenish Creek.

It is our working hypothesis that aquatic habitat is created by the watershed-scale interactions between water, soil, and vegetation. It follows that changes to these interactions will cause changes to the habitat. This view of aquatic conditions being influenced by upland conditions is supported by the FWP: "Maintaining and improving the productivity of salmon and steelhead habitat ... requires coordination of virtually all activities that occur in a subbasin... [I]f watershed restoration is to be successful, instream restoration should be accompanied by riparian and upslope restoration. A comprehensive watershed approach can help fisheries resources recover from their depressed state". The Toppenish watershed, being under single ownership and in a largely undeveloped state, offers a nearly ideal opportunity to translate this perspective into action.

FWP 7.6A Habitat Goal: Protect and improve habitat conditions to ensure compatibility with the biological needs of salmon, steelhead and other fish and wildlife species. Pursue the following aggressively.

7.6A.1 Ensure human activities affecting production of salmon and steelhead in each subbasin are coordinated on a comprehensive management basis.

The Toppenish Creek watershed is a vital element in the Yakima River subbasin. The scope of this project includes the potential to coordinate the human activities throughout most of the watershed, and throughout all the steelhead spawning and rearing habitat in the watershed.

7.6A.2 At a minimum, maintain the present quantity and productivity of salmon and steelhead habitat. Then, improve the productivity of salmon and steelhead habitat critical to recovery of weak stock.. Next, enhance the productivity of habitat for other stocks of salmon and steelhead. Last, provide access to inaccessible habitat that has been blocked by human development activities.

The Toppenish Watershed Project will be an in-kind mitigation project, extending the restoration activities undertaken by Satus Watershed Project personnel into the Toppenish watershed. Key personnel will include the interdisciplinary originators of this proposal (hydrologist and watershed biologist) who co-authored the proposal for the Satus Watershed Project, and have managed the Project since its inception in June 1996.

c. Relationships to other projects

Opportunities for cooperation

1. This project is principally an extension of the Satus Watershed Restoration Project (9603501) which, with funding from BPA, the Bureau of Indian Affairs, the Federal Emergency Management Agency, and the Washington Department of Transportation, has undertaken a major watershed analysis and restoration effort in the Satus Creek watershed since June 1996. The Satus Project crew has expertise, equipment, and local experience in water and fisheries monitoring that is key to the success of this project. Restoration activities will continue in the adjacent Satus Creek watershed, but we feel it is appropriate to transfer an increasing proportion of our restoration efforts to the upper Toppenish watershed.
2. This proposal complements the Toppenish/Simcoe Instream Flow Restoration project (5512000) and the Toppenish Creek Corridor Enhancement Project, a planning effort currently involving the Yakama Indian Nation under Public Law 103-434 (Yakima River Basin Water Enhancement Project or YRBWEP). Both of these projects focus on activities downstream from the project proposed here, but provide valuable information as part of a watershed approach and will help to establish watershed and stream connectivity.
3. The Yakima/Klickitat Fisheries Project (8812001 and others) is rearing spring chinook for supplementation at several locations in the Yakima subbasin. Issues related to culture techniques may delay steelhead supplementation under YKFP; this makes habitat restoration even more important to the health of the steelhead run.
4. The Yakama Nation’s Lower Yakima Valley Wetlands and Riparian Area Restoration Project (92600) is receiving $4.9 million from the Bonneville Power Administration to purchase, restore and manage riparian lands along the Yakima River, lower Toppenish Creek, and in lower Satus Creek. These efforts support the goal of the this proposal.

d. Project history (for ongoing projects)

This restoration proposal has been preceded by a proposal to perform a watershed analysis the upper Toppenish Creek Watershed in the latter part of fiscal year 1998 and the first half of fiscal year 1999. Restoration activities, guided by the results of the analysis will begin early in the 1999 field season. We anticipate that many of the restoration activities will be extensions of those undertaken in the adjacent Satus watershed by the Satus Watershed Project (begun in 1996).

e. Proposal objectives

Objectives

The Yakama Indian Nation proposes to improve fish habitat in Toppenish and Simcoe creeks by moderating the flow regime within the watershed. This will be accomplished by increasing the water retention capabilities of key areas within the watershed. Our objectives are:

1. stabilize headcuts in degrading channels,
2. retain sediment in incised and widened ephemeral/intermittent channels (channel aggradation, point bar building),
3. vegetate retained sediments with appropriate native plants,
4. enhance channel/floodplain interactions (i.e., reduce bankfull flow), and
5. stabilize sensitive eroding uplands.

These objectives are intended to be measurable indicators of reduced erosion or increased water retention capability within the key watershed areas being restored.

Products:

1. Rock sediment retention structures placed in ephemeral/intermittent channels,
2. increased native vegetation in denuded channels,
3. increased native vegetation on sensitive uplands,
4. fencing and stock water development, and
5. annual reports on the activities undertaken, and summary of monitoring data collected and analyzed in the course of this project

f. Methods

Methods, by Objective

1. Stabilize headcuts.

This activity is intended to arrest the headward progress of channel erosion throughout the drainage system. These sites are characterized by an oversteepened segment in the channel bed separating two relatively stable bed segments. This face erodes in the upstream direction during high flow periods, lowering the base level in the channel, and extending the tributary channel system in the upslope direction.

Headcuts will be stabilized using a combination of machinery and hand labor. The particular combination will depend on site conditions, primarily the availability of rock, the size of the headcut, and the peak flow expected in the channel under consideration. Headcuts will be laid back to create a stable slope (i.e., between 2:1 and 3:1), and stabilized with a blanket of rock or geotextile appropriate to the site conditions. The largest headcuts will require an excavator to lay back the slope and place rock. In most cases, however, a tractor with a front-end loader will transport rock to the site, and the rock will be placed by hand. Where a nearby rock source is not available, an excavator and a dump truck will be used to acquire rock from the nearest quarry site. Material for stabilizing the headcuts will be provided as an in-kind contribution..

2. Install sediment retention structures.

These structures will be installed in ephemeral and intermittent incised channels identified as being at a stage of channel development amenable to recovery processes (i.e., sufficiently widened to permit point bar development). Depending on site conditions, we will build permeable rock structures in these channels to accelerate sediment retention and channel aggradation.

Low, permeable rock structures will be installed at locations specified by resource professionals. These structures will function to dissipate energy, increase sinuosity, or increase channel/floodplain interactions, all of which will increase the deposition of sediment and hasten channel aggradation. As with the headcut stabilization, the installation work will involve a site-specific combination of machine work and hand labor. Most of the rock required will be imported from nearby quarries, and will be placed either by machine or by hand. Material for the structures will be provided as an in-kind contribution.

3. Stabilize sediment deposits.

The appropriate vegetative community is essential to channel recovery. Revegetation will be needed where native species appropriate to the site have been eliminated or severely suppressed. Most of the headwater meadows, drained by shallow swales, were previously dominated by native sedge/rush communities. Where revegetation is needed, small in-channel exclosures will be constructed into which the appropriate mixture of sedges and rushes will be transplanted. These sites will function as seed sources for revegetating the downstream channels with vegetation capable of capturing and stabilizing sediment.

Revegetation work will consist of hand labor and the use of a backhoe. We will construct exclosures, about 20 ft x 20 ft, within the treated, incised channels sites, and will transplant vegetation into these exclosures. This work will be largely hand labor, but will include the use of a backhoe for transplanting.

Materials to construct the exclosures, as well as the use of the backhoe, will be provided as an in-kind contribution.

4. Enhance channel/floodplain interactions

We anticipate that analysis will reveal the presence of dikes and other structures which restrict access to the floodplain by floodwaters. Typically, channels become incised in the vicinity of dikes and other floodplain obstruction; downstream of these erosional reaches, excessive bedload deposition often causes channel widening and simplification.

Wherever feasible, we will remove these structures, using an excavator and a dump truck. The changes caused by dikes and other obstructions often destabilize channels to a degree which seriously reduces the channel's ability to nondestructively dissipate the energy of high flows. This can cause a degraded equilibrium to occur in the channel conditions, even after removal of the obstruction. In these cases, the key to recovery is to increase the roughness of the stream/riparian system by: 1) improving access to the floodplain (i.e., causing overbank flow at a lower stage, and 2) increasing channel roughness. We will utilize large rock salvaged during dike removal to increase energy dissipation and floodplain connectivity (Reichmuth 1996). Depending on site-specific considerations, the rock will be used to increase backwater habitat, access to high flow channels, sinuosity, and point bar formation. No instream work will be undertaken with the intention of locking the active channel into its current location.

5. Stabilize eroding uplands.

Denuded upland areas where channelized flow is initiating (i.e., the transition zone between overland and channelized flow) will be targeted for revegetation. In most cases, this will be in the forest edge or the sagebrush/bunchgrass steppe where bunchgrasses are the most effective cover for the prevention of surface and rill erosion. The appropriate seed mix will be drilled with a tractor and rangeland drill, or broadcast using either hand-held or quad-runner mounted broadcasters. The tractor, drill, quad-runners and seed will be provided as in-kind contributions.

<u>Methods Common to All Objectives</u>

Fencing. To better mange grazing in sensitive areas, we will repair, replace, and relocate fence, using smooth wire, high tensile fencing. This work will be performed with a combination of hand labor and tractor work. The tractor will be provided as an in-kind contribution.

Stock water development. The installation of new water lines and troughs will be performed largely by hand labor, with some use of a backhoe, tractor, etc.. The use of the backhoe, tractor, and other equipment will be provided as an in-kind contribution.

<u>Monitoring</u>

Headcut stability and sediment retention structures will be monitored on an annual basis throughout the duration of this project.

Headcuts will be monitored visually to determine stability of the treated sites. Success of headcut stabilization will be evaluated based on the percentage of headcuts which have been arrested three years after completion of the project.

Sediment retention structures will be visually inspected to monitor for structural failures. Additionally, the depth of sediment retained will be measured by installing erosion pins at the upstream face of each structure. Success of the structures will be evaluated on two criteria: 1) the percentage of structures intact three years after completion of the project, and 2) the average depth of sediment accumulated above each structure. It is expected that the uppermost structures will initially retain sediment at higher rates than the structures further downstream, due to the limited supply of sediment available for capture. If this trend is observed, a third criteria for success will be included: sediment retention rates for the uppermost 10% of the structures installed. The lower structures will become more effective as the upper ones reach their retention capacities.

Channel revegetation will be monitored concurrently with monitoring headcut stability and sediment retention structures for two years following project completion. Success of vegetative establishment within the exclosures will be evaluated with line-intercept cover measurements; establishment rates downstream of the exclosures will be estimated. Revegetation success will be based on the change in vegetative cover within the exclosures composed of the transplanted species two years after completion of the project.

A subsample of treatment sites of headcut stabilization, sediment retention structures, and revegetation will be monitored using photo points, and their locations established using GIS coordinates. Equipment for this monitoring will be provided on an in-kind basis.

Enhance channel/floodplain interactions

Pre-treatment channel geometry will be measured at sample locations in the vicinity of treated sites; surveys will be repeated annually for three years. Bankfull flow will be estimated using channel survey data and Manning's equation (Maidment 1993).

Stabilize sensitive eroding uplands

Erosion pins will be placed at the heads of a sample of rills in each treated area. These will be monitored annually for headward expansion of the rills.

Riparian assessment.

The functional condition of the riparian areas of all the anadromous fish-bearing stream reaches and a sample of the intermittent/ephemeral streams in the upper watershed will be conducted in the first year. It is intended that these assessment will be repeated every 3-5 years to evaluate changes in stream/riparian condition.

g. Facilities and equipment

This proposal is intended to capitalize on the expertise, facilities, and equipment possessed by the YIN Satus Watershed Project by extending our restoration efforts into the Toppenish Creek watershed. Facilities include a fully furnished office, including computers and a copying machine. Equipment includes: vehicles, a tractor, 3 quad runners, 2 snow machines, stream discharge meters, water quality meters, pumping sampler, irrigation equipment, a variety of revegetation equipment and fencing material, and other miscellaneous equipment.

h. Budget

The most substantial budget item is personnel costs. This line item reflects .25 FTE's for three professionals (i.e., a hydrologist, watershed biologist, and wildlife biologist), and for five technicians. These positions represent the core watershed team assembled to perform restoration in the Satus Creek watershed; the staff hours accounted for here, combined with those in the proposal for continuing restoration efforts in Satus Creek will fully commit the efforts of these individuals. Additionally, we have included 200 hours for a fisheries manager to assist in administering the project, 100 hours for an archaeologist to provide cultural and archaeological resource protection during restoration activities, 40 hours for a geologist/geomorphologist who will provide technical assistance, and 160 hours for a bookkeeper.

Vehicles and office rental will also be shared with the Satus Watershed Restoration project, on the basis of 25% of the costs being absorbed by the budget for restoration in Upper Toppenish/Simcoe.

The other large ticket item (contained in the 'Other' line item) involves the rental of construction equipment needed to perform dike removal, headcut stabilization and sediment trap construction.

Other budgetary items are relatively small and incidental, involving such things as office supplies, erosion control materials, fencing materials, and miscellaneous field supplies. Collectively, these amount to approximately 8% of the total budget.

Section 9. Key personnel

Gina Ringer, hydrologist, and Tom McCoy, watershed biologist, will manage the project. They are co-authors of the grant proposals which initiated the Satus Watershed Restoration Project in June of 1996, and have been managing the project since that time. Additionally, they are key personnel in conducting the analysis which will yield the restoration plan directing the activities described in this proposal.

GINA RINGER

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Education:

M.S., Forest Hydrology, 1994
minor in ecology
Oregon State University

B.S., Civil Engineering, 1979
B.S., Agricultural Engineering,
University of California at Davis

Experience:

Watershed Hydrologist July 1996 - present
Yakama Indian Nation Satus Watershed Project, Toppenish, Washington
Develop and manage the Satus Watershed Project, implementing grants to perform watershed analysis and restoration; designing and supervising the installation of an extensive monitoring network; analyzing streamflow and climate records; planning and supervising the implementation of watershed restoration treatments; interdisciplinary assessment of riparian and upland areas; interdisciplinary watershed analysis and report preparation; hiring personnel; supervising; preparation and administration of contracts; preparation and delivery of presentations; preparation of funding proposals.

Hydrologist October 1994 - July 1996
Yakama Indian Nation Water Program, Wapato, Washington
Evaluate the effects of land use on the surface waters of the Yakama Reservation; advise staff and policy makers; make recommendations on issues involving surface waters; collect and analyze hydrologic data; hydrologic modeling; technical support; interdisciplinary planning of timber sales.

Hydrologist/Civil Engineer May 1994 - September 1994
Washington Department of Fish and Wildlife, Engineering and Technical Support Section of the Habitat Division, Olympia, Washington.
Hydrologic and hydraulic analysis of natural channels; interdisciplinary development of aquatic habitat restoration and flood risk management plans for the Dungeness and Quilcene rivers; verification and improvement of a model specifying design flows for fish passage.

Publications:

Adams, P.W. and G.O. Ringer. 1994. Summary and annotated bibliography of the effects of timber harvesting and forest roads on water quantity and quality in the Pacific Northwest. Oregon Forest Resources Institute.

Awards:

OSU College of Forestry Fellowship.

California State Scholarship**.**

Licenses and Professional Credentials:

Professional Engineer, California, license no. C35359.
Member, Washington State Riparian Proper Functioning Condition (PFC) training cadre.

Thomas H. McCoy

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Education:

M.S. Rangeland Ecology and Watershed Management
Emphasis – Hydrology
University of Wyoming, Laramie
1994

B.S. Business Administration
Emphasis – Management
Washington State University, Pullman
1989

Professional Experience:

Watershed Restoration Biologist / Satus Watershed Project Manager
Yakama Indian Nation, Toppenish, WA.
June 1994 to present

Since June 1996. Served as co-project manager for the Satus Watershed Restoration Project. Duties include: implementing watershed restoration and analysis projects, developing and monitoring restoration treatments, design-install watershed scale climate and streamflow monitoring network, report preparation and presentation, hiring and supervision, preparation and administration of grant proposals, interdisciplinary team member, media liaison.
September 1994 – June 1996. Addressed watershed related management issues on the Yakama Indian Reservation for the YIN Division of Natural Resources including: forestry/timber harvest, range management, riparian/wetlands restoration, and transportation issues. Also temporarily served as the YIN's technical representative to the U.S. Army Yakima Training Center.

Graduate Research Assistant
University of Wyoming, Laramie, WY.
June 1992 – June 1994

Duties in addition to graduate studies and research included: operation and maintenance of the Snowy Range Observatory and Pole Mountain Observatory (both are large groundwater – surfacewater – vegetation interaction research facilities), assisted with numerous other hydrologic and fish habitat restoration research projects

Preserve Ecologist/Manager
The Nature Conservancy, John Day, OR.
Summer 1991

Served as the newly established preserves manager including: design and implement vegetation and channel characteristic monitoring programs, liaison to federal, state, and county agencies, supervision.

Professional Credentials:
Member, Washington State Riparian Proper Functioning Condition (PFC) training cadre.

Section 10. Information/technology transfer

This project will be adjunct to the Satus watershed restoration. Experience gained in restoration activities in the adjacent Satus Creek watershed will be applied in the Toppenish Creek watershed; field observations suggest similar disturbances degrade the streams in the Toppenish watershed. Technology transfer from these complementary restoration projects will largely be from the Satus watershed, due to its longer duration and more extensive monitoring component.

Congratulations!